

THAT WHICH IS CLAIMED IS:

1. A transport unit for transporting containers of hyperpolarized gas products, comprising:
 - a housing;
 - at least four discrete spaced-apart permanent magnets held in said housing,
 - 5 wherein said permanent magnets are configured such that they are symmetrically arranged in spaced-apart relationship about a longitudinally extending axis defining a center therebetween to provide a magnetic field with a region of homogeneity
 - substantially centered with respect to the longitudinal axis, wherein each of said discrete permanent magnets is oriented such that the field direction produced thereby
 - 10 is substantially perpendicular to the longitudinal center axis; and
 - at least one container positioned in said housing proximate to said region of homogeneity, wherein said at least one container is sized and configured to hold a quantity of hyperpolarized gas product therein.
2. A transport unit according to Claim 1, wherein said spaced-apart permanent magnets are elongated and positioned in spaced-apart circumferential relationship to longitudinally extend a distance sufficient to define a substantially cylindrical volume projected in space.
3. A transport unit according to Claim 1, wherein said permanent magnets are positioned in spaced apart circumferential relationship to define a spherical volume projected in space.
4. A transport unit according to Claim 1, wherein each of said permanent magnets comprises opposing first and second surfaces, and wherein one of said first and second surfaces is a magnetic north pole and the other a magnetic south pole.
5. A transport unit according to Claim 1, wherein said at least one container is a plurality of containers, and said containers comprise a quantity of hyperpolarized noble gas product therein.

6. A transport unit according to Claim 1, wherein said housing comprises a metallic material configured to define a substantially continuous enclosure.

7. A transport unit according to Claim 1, wherein said housing includes four upstanding walls, and wherein said at least one container is configured such that a major portion of said container is spatially separated a predetermined distance from each of said four upstanding walls.

8. A transport unit according to Claim 7, wherein said predetermined distance is at least about 2 inches.

9. A transport unit according to Claim 5, wherein said containers further comprise a quantity of non-polarized buffer gas.

10. A transport unit for transporting containers of hyperpolarized gas products, comprising:
5 first and second spaced-apart opposing end plates;
a plurality of spaced-apart elongated permanent magnets having opposing first and second ends, each of said plurality of permanent magnets positioned to extend linearly between said first and second opposing end plates to provide a magnetic field
10 with a region of homogeneity therebetween; and
at least one container positioned between said first and second end plates within said region of homogeneity.

11. A transport unit according to Claim 10, wherein said plurality of spaced-apart elongated permanent magnets are positioned in spaced-apart circumferential relationship to define a projected cylindrical volume in space.

12. A transport unit according to Claim 10, wherein each of said elongated permanent magnets comprises opposing first and second surfaces, and wherein one of said first and second surfaces is a magnetic north pole and the other a magnetic south pole.

13. A transport unit according to Claim 10, wherein said plurality of elongated permanent magnets are flexible magnets.

14. A transport unit according to Claim 10, wherein said permanent magnets are rubber strip magnets.

15. A transport unit according to Claim 10, wherein said transport unit further comprises at least one support platform for holding said at least one container in a desired position within said transport unit.

16. A transport unit according to Claim 15, wherein said transport unit further comprises at least one holder sized and configured to receive a portion of said container therein, said holder positioned on said platform within said transport unit.

17. A transport unit according to Claim 10, wherein said transport unit further comprises a suspension support member and wherein said at least one gas container is suspended from said suspension support member.

18. A transport unit according to Claim 10, wherein said at least one container is a plurality of containers.

19. A transport unit according to Claim 16, wherein said holder is a support cup.

20. A transport unit according to Claim 16, wherein said holder is a tray configured to slide in and out of said transport unit.

21. A transport unit according to Claim 13, wherein each of said plurality of elongated permanent magnets is structurally secured to a longitudinally extending support member attached to each of said opposing end plates and wherein each of said plurality of magnets is configured to remain fixedly attached to said end plates via

5 said support members during installation and removal of said at least one gas container into and out of said transport unit.

22. A transport unit according to Claim 10, wherein said plurality of magnets is at least eight.

23. A transport unit according to Claim 10, wherein said first and second ends of said elongated permanent magnets are positionally held in alignment and attached to a respective one of said first and second end plates such that when viewed from an end, a perimeter drawn through the center of each of said elongated magnets
5 on each end plate defines a circle with substantially the same radius and a common center axis extending between said first and second end plates, and wherein each of said elongated magnets are spaced apart about the circumference of said circle, whereby said circles are projected along the length of said elongated magnets to define an outer perimeter in space having a cylindrically extending shape associated with the
10 magnetic field generated thereby.

24. A transport unit according to Claim 10, wherein said elongated magnets each have opposing first and second surfaces, one configured as a magnetic south pole and the other as a magnetic north pole, and wherein said elongated permanent magnets are substantially circumferentially spaced apart about a circle with
5 a center coincident with a longitudinal center axis extending therethrough, the center of the longitudinal center axis defining the center of a holding volume in said transport unit, and wherein a vertical diametrical line drawn through the center of the circle between the upper and lower points thereof defines a first vertical axis, wherein said elongated magnets are oriented such that the magnetic north pole surface is in a
10 fixed angular relationship with the first vertical axis.

25. A transport unit according to Claim 24, wherein each of said elongated magnets is associated with a first angle defining the position of each of said elongated magnets with respect to said first vertical axis, and wherein each of said elongated magnets is associated with a second angle between the direction of its magnetic north

5 and a second vertical axis drawn through the cross sectional center of the magnet, and wherein said first angle is half the magnitude of said second angle for each of said elongated magnets.

26. A transport unit according to Claim 24, wherein said elongated magnets are equally spaced-apart about the circle.

27. A transport unit according to Claim 10, further comprising a metallic housing sized and configured to hold said permanent magnets and end plates therein.

28. A transport unit according to Claim 10, wherein said end plates are end walls of a magnetically shielded transport unit defining an enclosed volume for holding said at least one container therein.

29. A transport unit according to Claim 10, further comprising a plurality of supplementary magnets positioned on end portions of selected elongated magnets and arranged to enlarge the region of homogeneity therein.

30. A transport unit for transporting hyperpolarized gas products, comprising:

at least one gas chamber configured to hold a quantity of hyperpolarized gas therein;

5 a first upstanding end wall comprising a first set of spaced-apart discrete permanent magnets positioned thereon;

a second upstanding end wall positioned in said transport unit spaced apart from and opposing said first wall to define a gas enclosure volume for holding said gas chamber therebetween, said second upstanding wall comprising a second set of
10 spaced-apart discrete permanent magnets positioned thereon;

wherein said first and second magnet sets are circumferentially arranged about two corresponding circles with corresponding first diameters and aligned centers on said first and second walls, respectively;

wherein each of said discrete permanent magnets has a magnetic north and

15 south pole associated therewith; and

said first magnet set is arranged on said first wall such that the magnetic north pole of each magnet in said first magnet set is directed toward the center of the circle that said first magnet set is arranged thereabout, and the magnetic south pole of each magnet in said second magnet set is directed toward the center of the circle around

20 which said second magnet set is arranged about; and

wherein said permanent magnets in each of said first and second magnet sets are arranged to laterally extend toward the other a minor distance to define a central free space with a magnetic holding field having a region of homogeneity therebetween.

31. A transport unit according to Claim 30, wherein said first and second magnet sets comprise an equal number of discrete permanent magnets, and wherein said first and second magnet sets are arranged such that each of said permanent magnets in said first set is aligned with an opposing permanent magnet in said second set.

32. A transport unit according to Claim 31, wherein each of said permanent magnets in said first and second sets is disposed such that it is diametrically opposed from another of said permanent magnets in its respective first or second set.

33. A transport unit according to Claim 30, further comprising third and fourth upstanding walls and opposing top and bottoms which together with said first and second walls define a metallic housing, and wherein said housing is spaced apart a predetermined separation distance from the perimeter of the gas chamber holding a major volume of said hyperpolarized gas therein.

34. A transport unit according to Claim 30, wherein said first and second walls are positioned inside a structural housing, and wherein said housing is configured to be spatially separated a predetermined separation distance from the perimeter of the gas chamber holding a major volume of said hyperpolarized gas

5 therein.

35. A transport unit according to Claim 33, wherein said predetermined distance is at least about 2 inches.

36. A transport unit according to Claim 34, wherein said predetermined distance is at least about 2 inches.

37. A transport unit according to Claim 31, wherein said equal number of separate permanent magnets is at least eight.

38. A transport unit according to Claim 30, further comprising a gas platform positioned in said transport unit such that each of said at least one gas chamber is held substantially along a common axis proximate to the magnetic holding field region of homogeneity.

39. A transport unit according to Claim 30, wherein said at least one gas chamber is a plurality of gas chambers.

40. A transport unit according to Claim 30, wherein said permanent magnets are disk magnets.

41. A transport unit according to Claim 30, further comprising a third supplementary set of magnets arranged to be circumferentially spaced apart about a third circle having a second diameter, wherein said set of supplementary magnets is positioned intermediate said first and second magnet sets.

42. A transport unit according to Claim 41, wherein said second diameter is greater than said first diameter.

43. A transport unit according to Claim 42, wherein said first diameter is about between 0.4 to 0.8 times the size of said second diameter.

44. A transport unit according to Claim 42, wherein magnets comprising said supplementary set of magnets have a north pole and a south pole associated therewith, and

5 wherein said north pole of said supplementary magnet points normal to the plane defined by said third circle and in the direction of a plane defined by said first circle.

45. A transport unit according to Claim 41, wherein said third supplementary set of magnets is positioned as an equatorial set of magnets.

46. A transport unit according to Claim 30, further comprising a first quantity of a hyperpolarized gas and a second quantity of a buffer gas held in said at least one gas chamber.

47. A method of fabricating a cylindrically shaped magnetic field volume, comprising the steps of:

rolling a flexible magnetic sheet into a first hollow cylinder such that the ends touch but do not overlap;

5 applying a magnetic field to the cylindrically configured flexible magnetic sheet;

unrolling the flexible magnetic sheet; and

rerolling the flexible magnetic sheet into a second hollow cylinder such that the ends touch but do not overlap, and such that the side that was inside said first
10 hollow cylinder is on the outer side of said second hollow cylinder.

48. A transport unit for holding a quantity of hyperpolarized gas therein comprising:

at least one container for holding hyperpolarized gas;

5 a flexible material layer having an applied magnetization, wherein said flexible layer is configured as a cylinder, wherein said flexible material layer has magnetic north and south poles thereon, and a magnetic field strength associated therewith, wherein said flexible material layer defines a homogeneous magnetic holding field

operably associated with said gas container; and
a housing configured to receive said flexible material cylinder and said gas
10 container therein.

49. A transport unit according to Claim 48, wherein said at least one
container is a plurality of containers.

50. A transport unit according to Claim 48, wherein said housing includes
four upstanding walls, and wherein said walls are at least 2 inches away from said gas
container.

51. A transport unit according to Claim 48, wherein said flexible material
layer is magnetized such that the direction of the magnetic north varies about the
circumference of said cylinder.

52. A transport unit according to Claim 51, wherein said flexible cylinder
includes a continuous surface represented by a plurality of adjacent points drawn in
space;

wherein each point on said flexible cylinder has a direction of magnetic north
5 associated therewith;

wherein each of said plurality of points has a first vertical axis associated
therewith which intersects said point;

wherein said flexible cylinder has a second vertical axis associated therewith
which diametrically extends to bisect opposing top and bottom surfaces of the
10 cylinder; and

wherein said flexible cylinder is configured such that at any point, a first angle
between said magnetic north direction and said first vertical axis is about twice the
magnitude of a second angle between said second vertical axis and a line to said point
from the center of said second diametrical axis.